Claims

1. A block copolymer having a weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene of 60/40 to 90/10 and a number average molecular weight measured by gel permeation chromatography (GPC) of 30,000 to 500,000,

wherein the vinyl aromatic hydrocarbon constituting the block copolymer has a block rate of from 10 to 90% by weight, the vinyl aromatic hydrocarbon polymer blocks constituting the block copolymer have a peak molecular weight within the molecular weight range of 5,000 to 30,000, and 40 to 80% by weight of the vinyl aromatic hydrocarbon polymer blocks have a molecular weight of 35,000 or less.

2. The block copolymer according to claim 1, wherein the vinyl aromatic hydrocarbon polymer blocks have peak molecular weights within the molecular weight range of 5,000 to 30,000 and within the molecular weight range of 35,000 to 150,000, respectively.

3. The block copolymer according to claim 1 or 2, which comprises:

10 to 90 parts by weight of a block copolymer (component 1) having a weight ratio of a vinyl aromatic

hydrocarbon and a conjugated diene constituting the block copolymer of from 70/30 to 95/5, wherein the vinyl aromatic hydrocarbon polymer blocks have peak molecular weights within the molecular weight range of 5,000 to 30,000, and within the molecular weight range of 35,000 to 150,000, respectively; and

90 to 10 parts by weight of a block copolymer (component 2) having a weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene constituting the block copolymer of from 50/50 to 85/15, wherein the vinyl aromatic hydrocarbon polymer blocks have peak molecular weights within the molecular weight range of 5,000 to 30,000, and within the molecular weight range of 35,000 to 150,000, respectively,

with the proviso that the total amount of component 1 and component 2 is 100 parts by weight, and that component 1 has a vinyl aromatic hydrocarbon content larger than that of component 2 by at least 3% by weight.

4. The block copolymer according to claim 1 or 2, which comprises:

10 to 90 parts by weight of a block copolymer (component 1) having a weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene constituting the block copolymer of from 70/30 to 95/5, wherein the vinyl

aromatic hydrocarbon polymer blocks have peak molecular weights within the molecular weight range of 5,000 to 30,000, and within the molecular weight range of 35,000 to 150,000, respectively; and

90 to 10 parts by weight of a block copolymer (component 3) having a weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene constituting the block copolymer of from 50/50 to 85/15, wherein the vinyl aromatic hydrocarbon polymer blocks have a peak molecular weight within the molecular weight range of 5,000 to 30,000,

with the proviso that the total amount of component 1 and component 3 is 100 parts by weight, and that component 1 has a vinyl aromatic hydrocarbon content larger than that of component 3 by at least 3% by weight.

5. The block copolymer according to claim 1 or 2, which comprises:

10 to 90 parts by weight of a block copolymer (component 4) having a weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene constituting the block copolymer of from 70/30 to 95/5, wherein the vinyl aromatic hydrocarbon polymer blocks have a peak molecular weight within the molecular weight range of 5,000 to 30,000; and

90 to 10 parts by weight of a block copolymer (component 2) having a weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene constituting the block copolymer of from 50/50 to 85/15, wherein the vinyl aromatic hydrocarbon polymer blocks have peak molecular weights within the molecular weight range of 5,000 to 30,000, and within the molecular weight range of 35,000 to 150,000, respectively,

with the proviso that the total amount of component 4 and component 2 is 100 parts by weight, and that component 4 has a vinyl aromatic hydrocarbon content larger than that of component 2 by at least 3% by weight.

6. The block copolymer according to claim 1 or 2, having a content of short-chain vinyl aromatic hydrocarbon polymer moieties with a vinyl aromatic hydrocarbon unit number of 1 to 3, of from 1 to 25% by weight based on the total amount of the vinyl aromatic hydrocarbons constituting the block copolymer.

7. The block copolymer according to claim 1 or 2, wherein the conjugated diene constituting the block copolymer comprises butadiene and isoprene, and the weight ratio of butadiene and isoprene in the block copolymer is within the range of 3/97 to 90/10.

8. The block copolymer according to claim 1 or 2, wherein at least one polymer block selected from the group consisting of (i) a copolymer block comprising isoprene and 1,3-butadiene, (ii) a copolymer block comprising isoprene and a vinyl aromatic hydrocarbon and (iii) a copolymer block comprising isoprene, 1,3-butadiene and a vinyl aromatic hydrocarbon is incorporated into the block copolymer.

9. A hydrogenated block copolymer obtained by hydrogenating the block copolymer according to claim 1 or 2.

10. The hydrogenated block copolymer according to claim 9, which has a crystallization peak in a temperature region of 20°C or higher, in a differential scanning calorimetry (DSC) chart.

11. A block copolymer composition comprising:

component (A) which is the block copolymer according to claim 1 or 2 or a hydrogenated product thereof; and

component (B) which is a vinyl aromatic hydrocarbon polymer,

wherein the weight ratio of component (A) and component (B) is from 99.9/0.1 to 20/80.

12. The block copolymer composition according to claim 11, wherein the vinyl aromatic hydrocarbon polymer of component (B) is at least one member selected from the group consisting of the following a) to c):

a) styrene polymers

b) aliphatic unsaturated carboxylic acid ester-styrene copolymers, and

c) rubber-modified styrene polymers.

13. The block copolymer composition according to claim 11, which contains at least one lubricant selected from the group consisting of fatty acid amides, paraffins, hydrocarbon resins, and fatty acids in an amount of 0.01 to 5 parts by weight per 100 parts by weight of the block copolymer or hydrogenated product thereof.

14. The block copolymer composition according to claim 11, which contains at least one stabilizer selected from the group consisting of 2-[1-(2-hydroxy-3,5-di-t-pentylphenyl)ethyl]-4,6-di-t-pentylphenyl acrylate, 2-t-butyl-6-(3-t-butyl-2-hydroxy-5-methylbenzyl)-4-methyl-phenyl acrylate and 2,4-bis[(octylthio)methyl]-o-cresol in

an amount of 0.05 to 3 parts by weight per 100 parts by weight of the block copolymer or hydrogenated product thereof.

15. The block copolymer composition according to claim 11, which contains at least one ultraviolet absorber or light stabilizer selected from the group consisting of benzophenone-based ultraviolet absorbers, benzotriazole-based ultraviolet absorbers and hindered amine-based light stabilizers in an amount of 0.05 to 3 parts by weight per 100 parts by weight of the block copolymer or hydrogenated product thereof.

16. A sheet/film comprising the block copolymer or hydrogenated product thereof, or the block copolymer composition according to any one of claims 1 to 15.

17. A heat shrinkable film obtained by stretching the film comprising the block copolymer or hydrogenated product thereof, or the block copolymer composition according to any one of claims 1 to 15, wherein the film has a heat shrinkage ratio at 65°C in the stretching direction of from 5 to 60%, and a tensile elastic modulus in the stretching direction of 7,000 to 30,000 Kg/cm^2.

18. A heat shrinkable multilayer film comprising as at least one layer of the multilayer film a layer obtained by stretching a film comprising the block copolymer or hydrogenated product thereof, or the block copolymer composition according to any one of claims 1 to 15, wherein the heat shrinkage ratio at 80°C in the stretching direction is from 10 to 80%.

19. A heat shrinkable multilayer film comprising as at least one layer of the multilayer film a layer comprising the block copolymer or hydrogenated product thereof, or the block copolymer composition according to any one of claims 1 to 15, which has at least two peak molecular weights within the range of 40,000 to 300,000, in the gel permeation chromatography (GPC) measurement, and moreover, has at least one tanδ peak temperature within the temperature range of 90 to 125°C, in the dynamic viscoelasticity measurement.

20. The heat shrinkable multilayer film according to claim 18 or 19, having a heat shrinkage ratio at 65°C in a stretching direction of from 5 to 60%, and a tensile elastic modulus in a stretching direction of 7,000 to 30,000 Kg/cm^2.